Fungi Isolated from Tropical and Sub-Tropical Fruits in Thailand

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Introduction

Many varieties of tropical and sub-tropical fruits are grown in Thailand, including banana (*Musa sapientum* L.), mango (*Mangifera indica* L.), papaya (*Carica papaya* L.), guava (*Psidium guajava* L.), sugar apple (*Annona squamosa* L.), rose apple (*Eugenia jambos* L.), strawberry (*Fragaria chiloensis* Done). Thai fruits seem to be among the most delicious in the world and some of them are exported to several countries such as Singapore, Hong Kong, and Malaysia. Because of the warm weather and high humidity conditions, the fruits rot very easily during transportation and storage. The problem mainly arises from environmental factors in combination with fungal diseases. It has been reported that *Botryodiplodia theobromae* Pat., *Rhizopus* and *Colletotrichum* species infect various kinds of fruits and cause fruit rots during ripening, transportation and storage[1,2,3,4,5,6]. In this study, we attempted to determine what kinds of fungi could be isolated from these fruits.

Materials and Methods

Seven kinds of fruits, i.e.mango, banana, papaya, guava, sugar apple, rose apple and strawberry were obtained from markets in Bangkok or Chiang Mai (for strawberry) at appropriate seasons. After taking photographs and making a mount on a microscopic slide, diseased samples were kept in the refrigerator for further studies.

The diseased samples were used for isolation of fungi on potato dextrose agar (PDA). Small pieces of fruit tissue (3×3 mm.) were excised at the margin of the diseased and non-diseased tissue. After immersion in 10% clorox for 3–4 minutes, the samples were transferred to a petri dish of PDA and incubated for a few days under a fluorescence light/darkness regime (12hr./12hr.). The hyphal tips of growing colonies were then transferred to PDA slants to maintain them as pure cultures for morphological and physiological studies and pathogenicity tests of the fungus. These cultures were incubated at 26°C for a week and the identification was made by means of the slide culture method.[7,8,9,10]

Results and Discussion

Fungi isolated from seven kinds of fruits are listed in Table 1. *Botryodiplodia theobromae* Pat. from banana, guava, mango, sugar apple and strawberry (Figs. 1 A, B, C, D, E)†, *Colletotrichum*

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musae (Berk. & Curt.) Arx. from banana (Figs. 2 A, B)†, *Colletotrichum gloeosporioides* (Penzig) Sacc. from mango, guava, and rose apple (Figs. 3 A, B, C)†, *Colletotrichum* species from papaya (Figs. 4 A, B)†, *Pestalotia* species (Figs. 5 A, B)† from rose apple, *Rhizopus nigricans* Ehrenb. and *Botrytis cinerea* Pers. ex Fr. from strawberry (Figs. 6 A, B, C)† were detected respectively.

Botryodiplodia theobromae causing fruit rot on a wide range of hosts, is a common soil fungus in Thailand. According to Punithalingam[1] "This fungus is predominantly a facultative wound pathogen, causing diseases in living plants and also preharvest and storage rots of fruits and yams, either alone or in combination with one or more other microorganisms". In this study, we found that *B. theobromae* usually penetrates through the wound at the scar of the ripening fruits (Figs. 1 B, C, D, E)† whereas *Colletotrichum* species normally penetrates through the host epidermis directly. More detailed studies on *Botryodiplodia* fruit rots of mango and banana[4, 5] showed that ripening fruits tend to rot rapidly due to the lack of tannin. Morphological as well as physiological studies of this fungus have been conducted. Different plant varieties were tested and the disease characteristics varied from plant to plant. The fungus isolated from banana could infect orange, rambutan, and guava. The effective way of eradicating infection in banana is hot water treatment at 54°C for 5 minutes followed by the storage of the fruit at 20°C. The use of Benlate at a concentration of 1000 ppm for 10 minutes is recommended for mango. Pathogenicity tests of *Botryodiplodia theobromae* on mango and banana were conducted[4,5]. A morphological study on the anthracnose fungus causing

Table 1. Fungus genera isolated from 7 kinds of tropical and sub-tropical fruits in Thailand

Genera of fungi isolated	Host plants	Diseases
Botryodiplodia theobromae Pat.	banana	fruit rot
	guava	stylar end rot
	mango	stem end rot
	strawberry	fruit rot
	sugar apple	fruit rot
Botrytis cinerea Pers. ex Fr.	strawberry	grey mold rot
Colletotrichum musae (Berk.& Cur.)Arx.	banana	anthracnose
Colletotrichum gloeosporioides (Penzig) Sacc.	guava	anthracnose
	rose apple	anthracnose
	mango	anthracnose
Colletotrichum sp.	papaya	anthracnose
Pestalotia sp.	rose apple	fruit rot
Rhizopus nigricans Ehrenb.	strawberry	water soft rot

fruit rot of three varieties of rose apple confirmed that the fungus was *Colletotrichum gloeosporioides*[6]. *Colletotrichum* species could damage many kinds of fruits during the transportation and storage. *Rhizopus* species normally occur on many varieties of fruits in a warm and humid area whereas *Botrytis cinerea* prefers cooler conditions.

Concluding Remarks

Seven isolates of fungi assigned to five genera were recovered from seven kinds of tropical and sub-tropical fruits i.e.mango, banana, papaya, guava, sugar apple, rose apple, and strawberry. *Botryodiplodia theobromae* and *Colletotrichum* species have the widest host range and can infect many different plant varieties. Other fungi identified in this investigation included *Botrytis cinerea*, *Pestalotia* sp. and *Rhizopus nigricans*.

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† See frontespiece

Fig. 1 A: *Botryodiplodia theobromae* Pat., pycnidia and conidia
B, C, D, E: Fruit rot of banana, guava, mango, sugar apple incited by *B. theobromae*, respectively.

Fig. 2 A: *Colletotrichum musae* (Berk. & Curt.) Arx, acervulus and conidia
B: Fruit rot of banana caused by *C. musae*

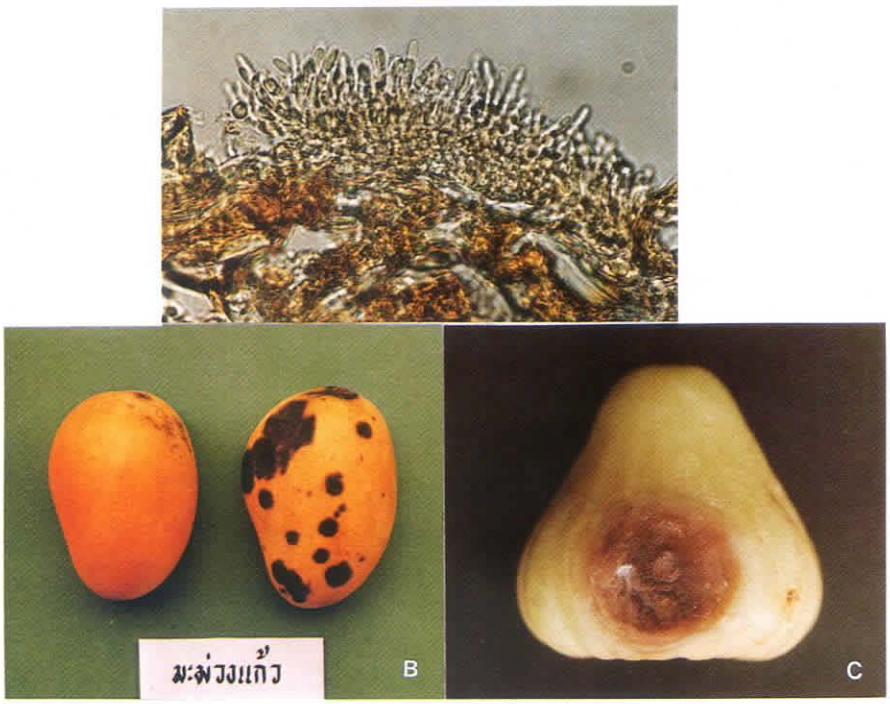

Fig. 3 A: *Colletotrichum gloeosporioides* (Penzig) Sacc., acervulus and conidia
B, C: Anthracnose of mango and rose apple caused by *C. gloeosporioides*

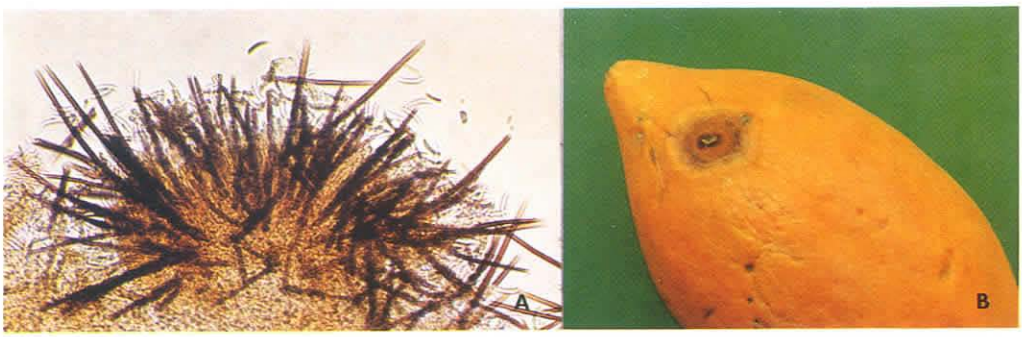

Fig. 4 A: *Colletotrichum* sp., acervulus, conidia and setae
B: Anthracnose of papaya caused by *Colletotrichum* sp.

Fig. 5 A: *Pestalotia* sp., acervulus and conidia
B: Fruit rot of rose apple

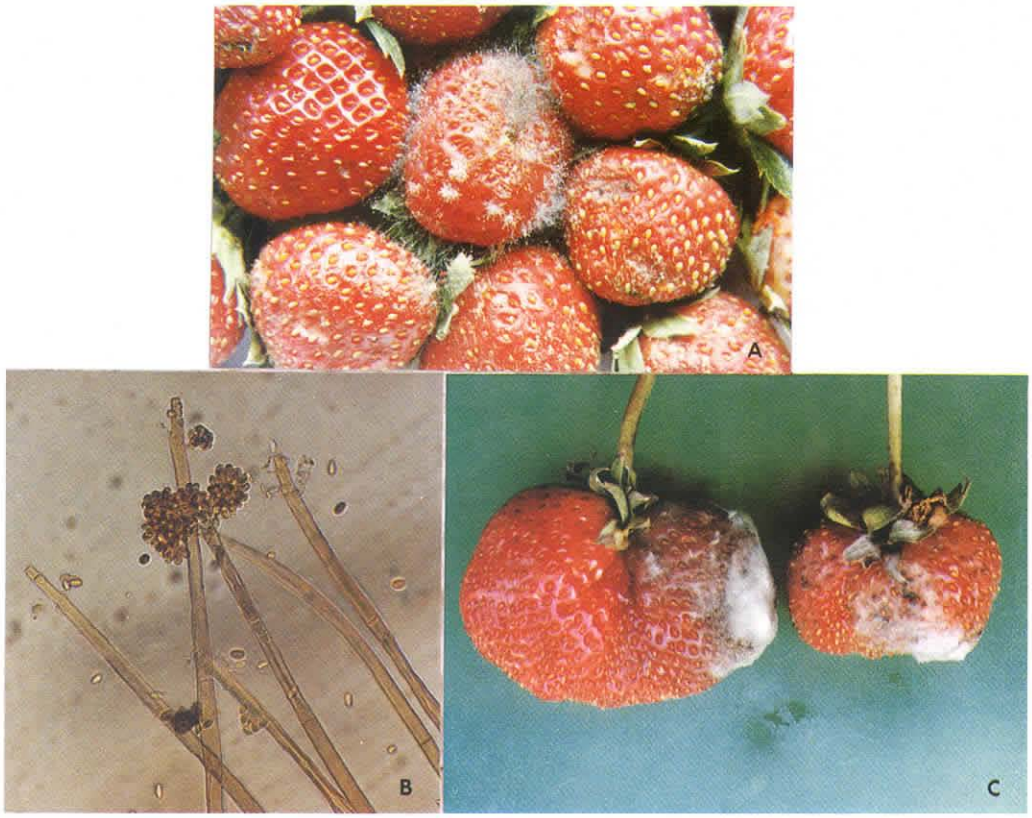

Fig. 6 A: Rhizopus rot (water soft rot) of strawberry.
B: *Botrytis cinerea*, conidia and conidiophore
C: Strawberry fruit rot incited by *B. cinerea*